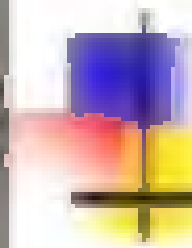
The Building in Oct 2001

A tour of Cambridge

Derek McAuley
Deputy Director
MSR Cambridge



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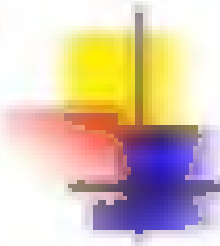
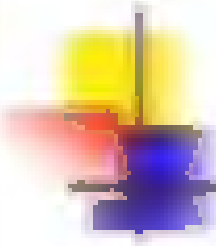


Cambridge Lab Overview

- Lab established in June, 1997
- Pan-European
  - msrcfrog has 11 members!
  - 12 nationalities
- Now at 50 researchers
- Close collaboration with Cambridge University
  - Computer Lab for language, security and systems
  - Engineering for machine learning and vision
  - Statslab for networking



MSR / CU interactions

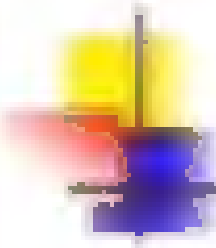
- Joint projects
- Co-supervision of PhD students
- Several lecture courses given
- Drink in the same pub
- Open seminars

A typical month

05-Jun-00	Tom Ball	Boolean Programs: A Model and Process for Software	EXT
06-Jun-00	Rick Rashid	The Future – it isn't what it used to be	INT
07-Jun-00	Peter Druschel	The ScalaServer project: Designing scalable, high-	EXT
08-Jun-00	Steve Muir	Operating System Support for High-Performance Server	EXT
08-Jun-00	Alex Smola	MLP Sparse Greedy Methods for Learning	EXT
09-Jun-00	Hugo Zaragoza	A Dynamic Probability Model from Complex Information...	EXT
13-Jun-00	Tuomas Aura	Extending the applications of public-key certificates	EXT
19-Jun-00	Arno Puder	MICO- an Open Source CORBA implementation	EXT
20-Jun-00	Brendan Frey	MLP Learning mixtures of smooth, nonuniform deformation	EXT
21-Jun-00	Mauro Pezze	Testing Object Oriented Software	EXT
23-Jun-00	Patrick Dussud	The COM+ EE Garbage Collector	INT
26-Jun-00	Adrian Perrig	Efficient authentication and signing of multicast streams	EXT

Our subjects

- Computer Security
- Information Retrieval And Analysis
- Machine Learning and Perception
- Networking
- Systems and Performance
- Programming Principles and Tools



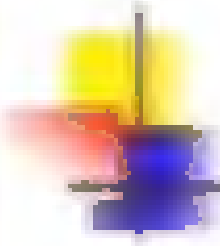
Security

- Theory and language for security and mobility
- Security support for product
- http-SIM
  - Implementation of http server on WfSC
  - "Access enabling wallets on user controlled devices"

Computational Number Theory

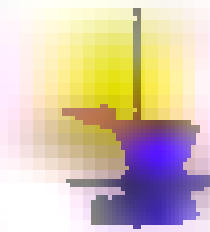
- GIMPS (Great Internet Mersenne Prime Search)
  - Mersenne numbers $M_p = 2^p - 1$
  - 1999 result $M_{6,972,593}$ is prime
  - Why? Because it's there...

- CABAL (~20 members include RSA (CMU), CWI, Citibank, Sun, INRIA...)
  - Last year broke RSA-155 challenge
  - Why? Because 512 bit RSA keys protect the global financial systems...
  - Seeking parallelization of linear algebra



"Traditional" machine learning

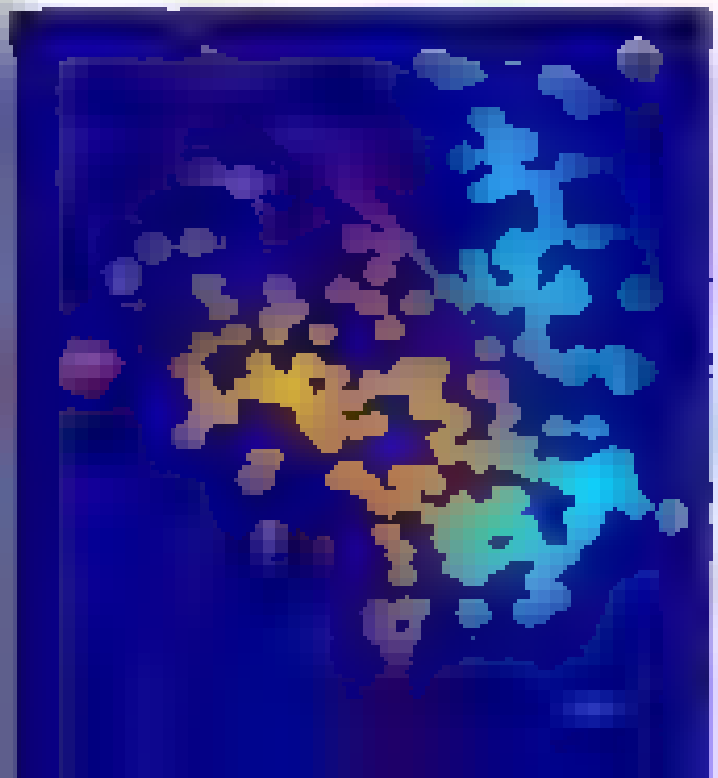
- The usual suspects:
  - Speech
  - Handwriting
  - Image content
  - Textual semantics
  - ...

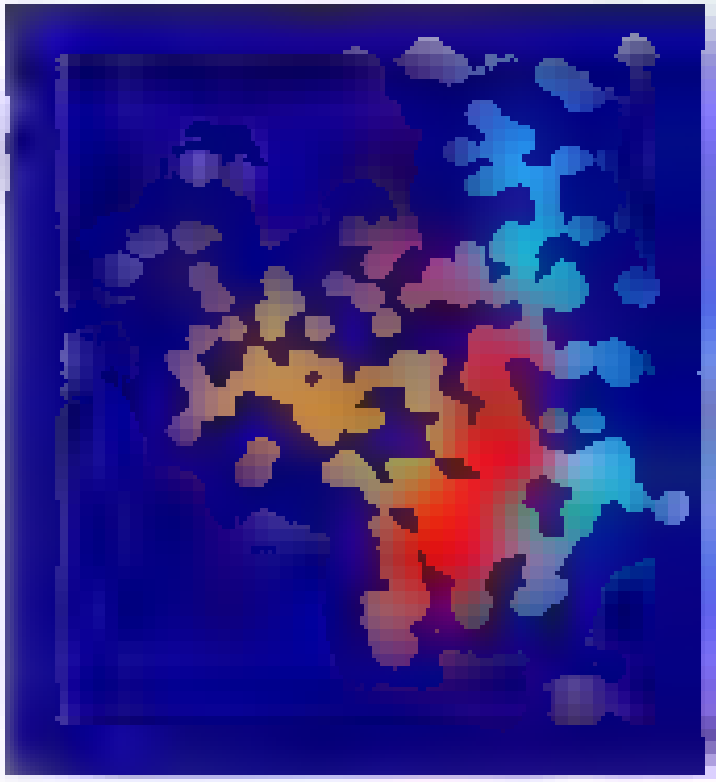


"Relevance Vector Machine"

- Provides high recognition accuracy
- Key feature: very compact
  - runs very quickly
  - requires minimal memory storage
- e.g. handwriting in a PDA

RVM Illustration





LiveSpline Project

LiveSpline Project

Cut and paste

LiveWire v. LiveSpline

- Pixel contour
- Background leakage
- Aliasing

V.

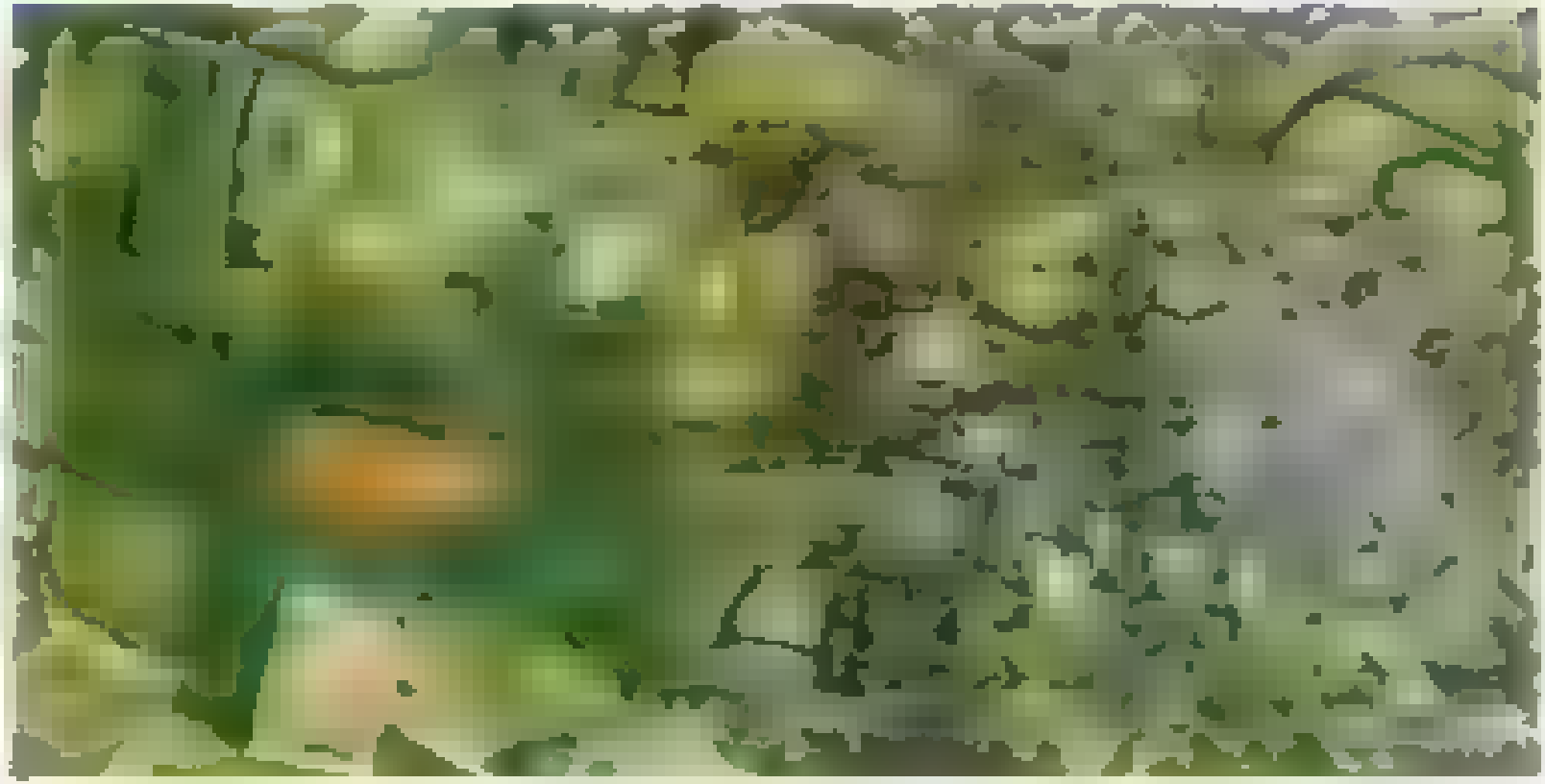
- Curve as contour (in future learn priors)
- Subpixel edge detection
- Fix alpha computation

LiveSpline

New MSR building

- Ground-breaking on **11th July 2000.**
- Completion next year.
- We want reconstruct a **3D Virtual model** of the building while it is being constructed.

Cambridge from the air



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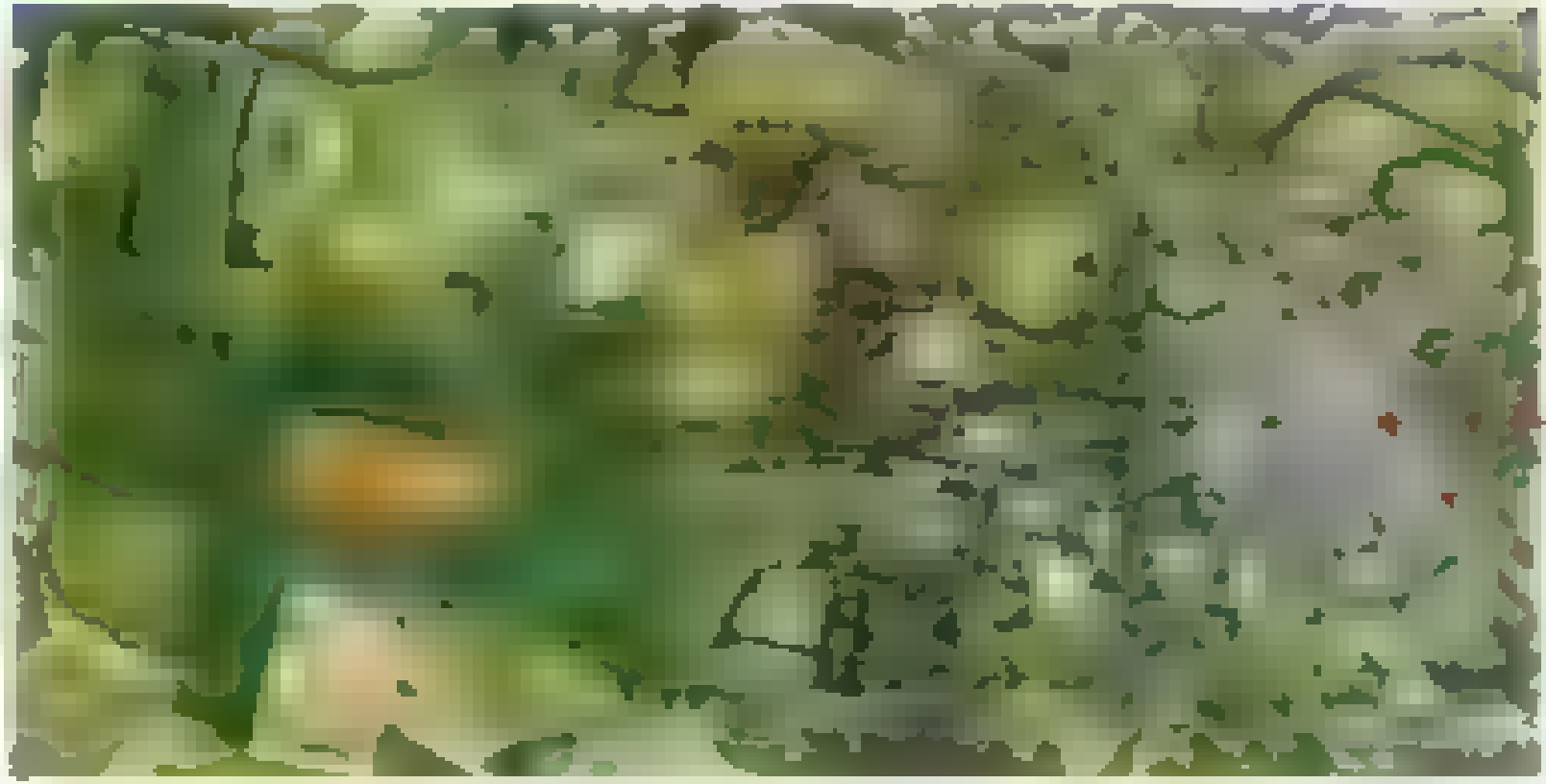
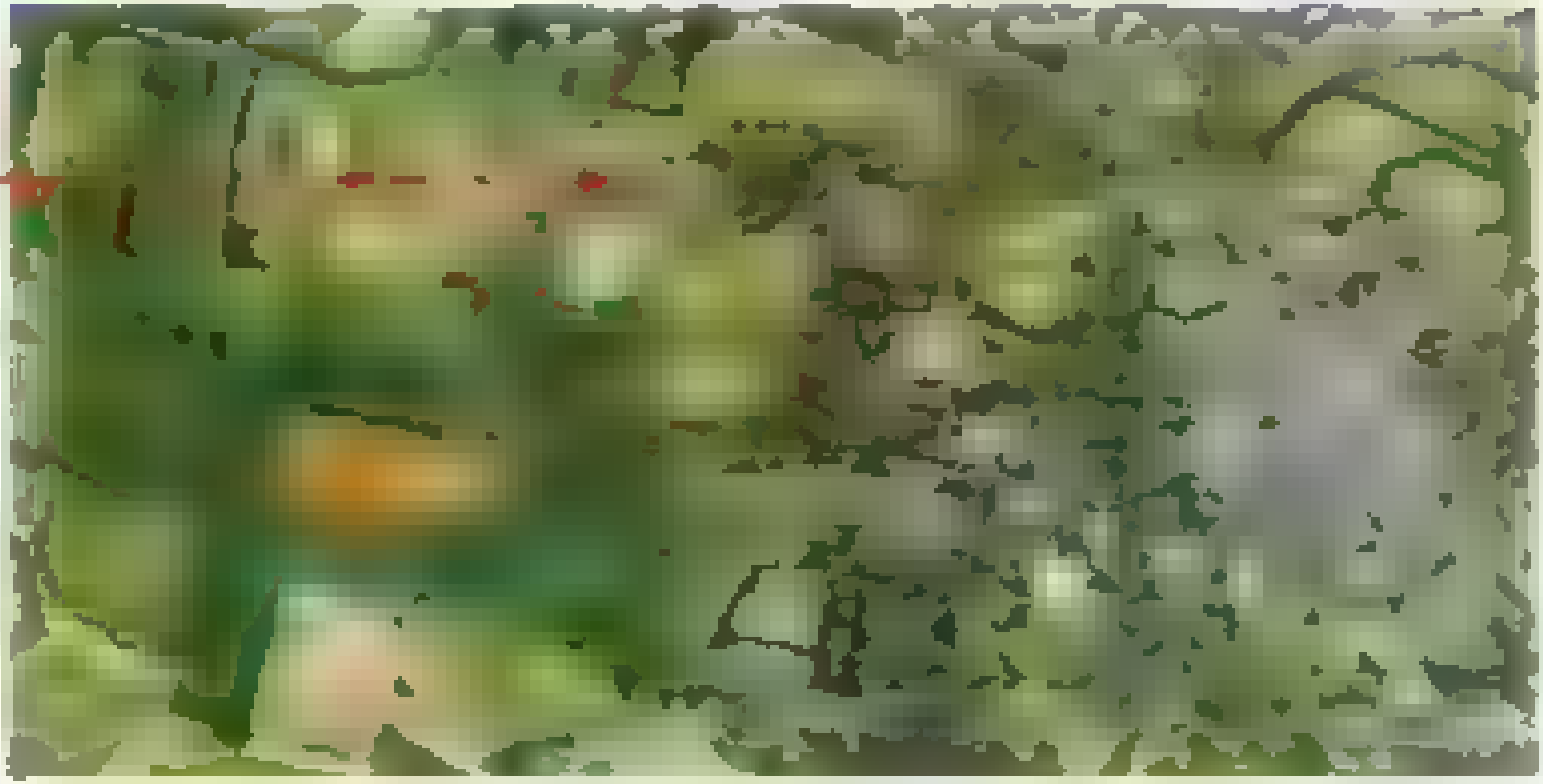


Cambridge from the air



Cambridge from the air

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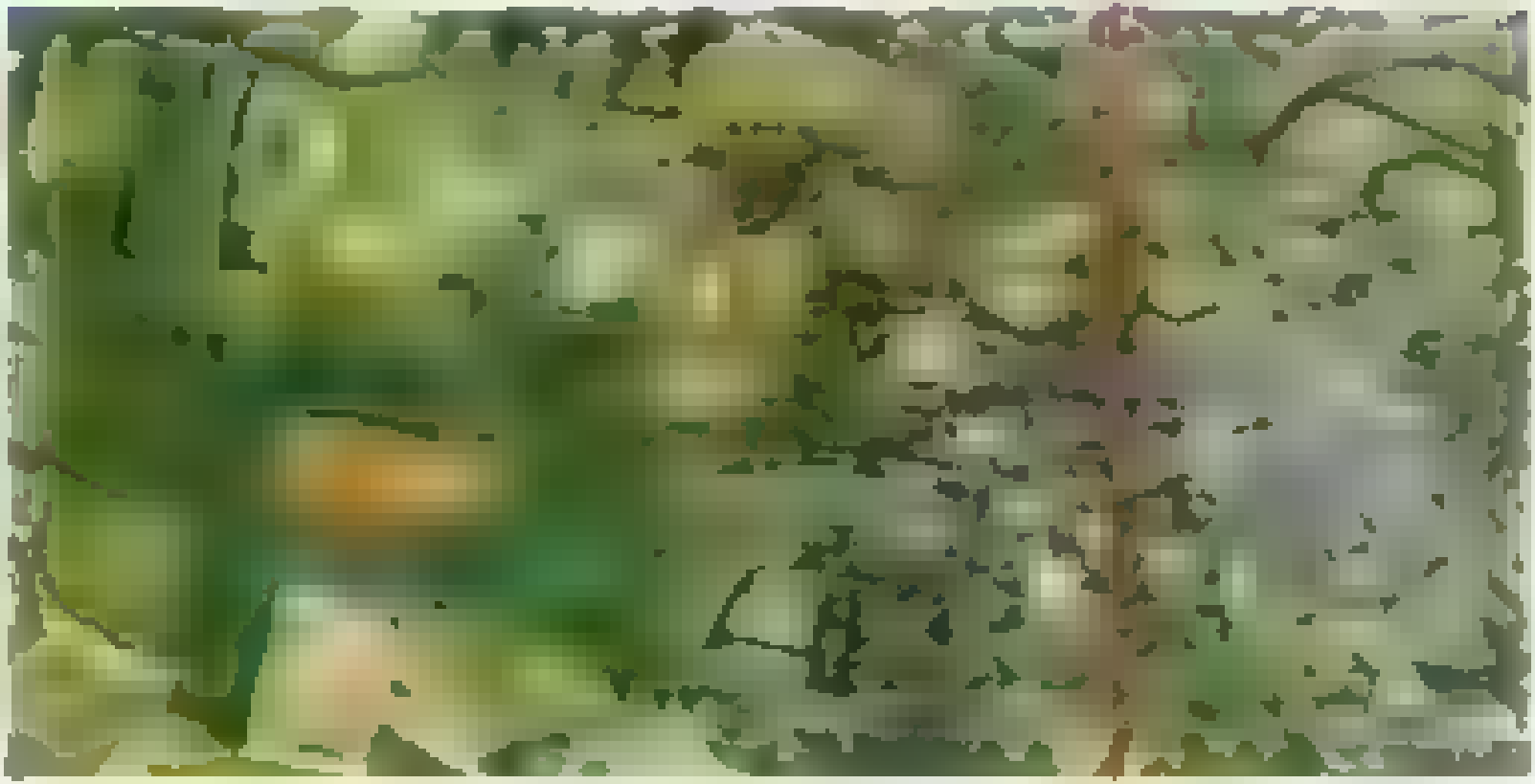


Virtual MSRC project

- Three cameras are being installed next to the building site.
- Process image with Computer Vision tools.
- Construct 3D model and put on the web.

Today: There's a Crane

Image from 09-Aug-2000

- Developing the necessary [illegible] and [illegible]
- Testing [illegible] examples
- [illegible] of [illegible]

West
Cambridge

An example building

The three input images

Images of the reconstructed 3D model

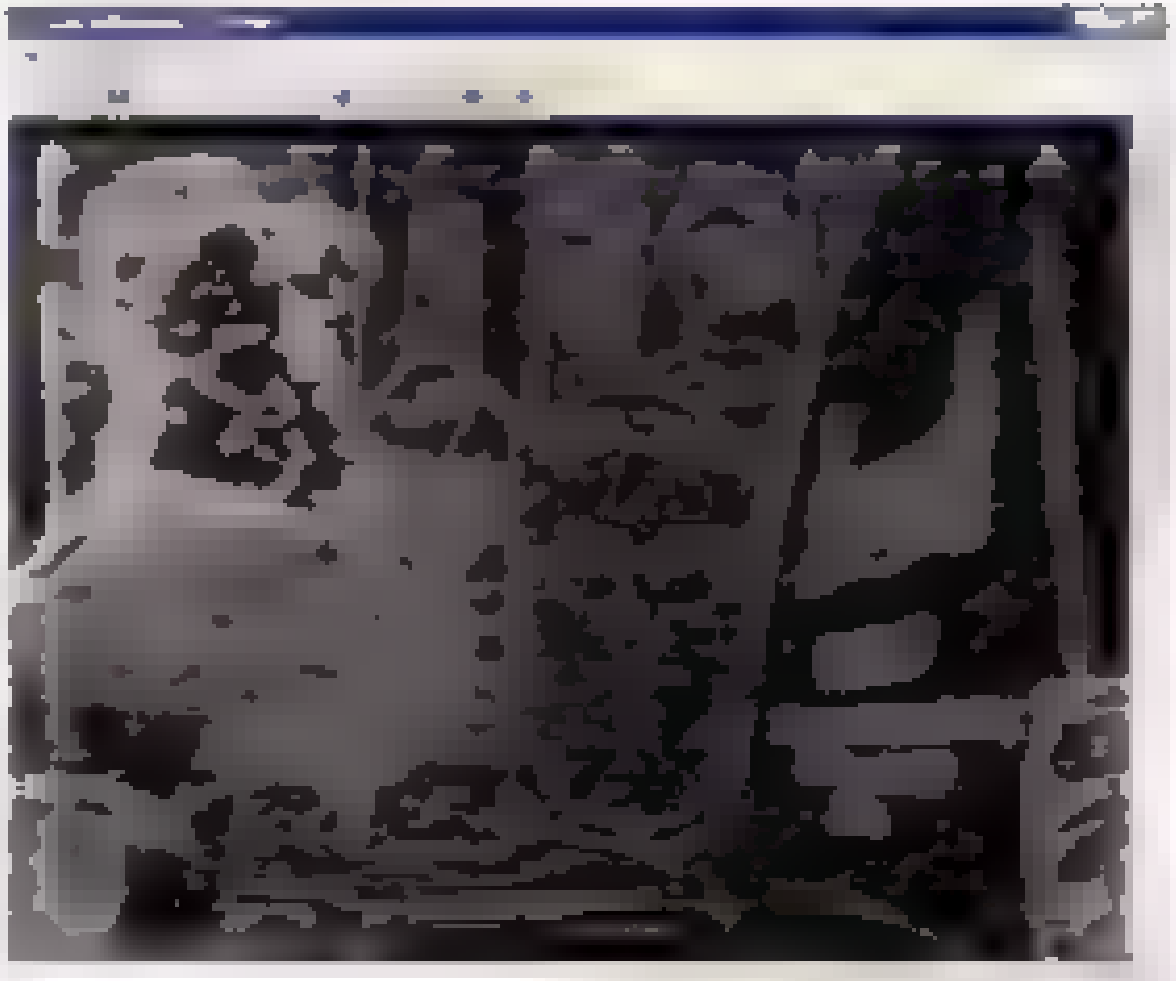
Future Work

Improving the [illegible] and [illegible] by:

- better matching of features across views;
- improving the reconstruction of edges;
- better occlusion reasoning;
- plane fitting to planar walls.

HocusFocus

HocusFocus index

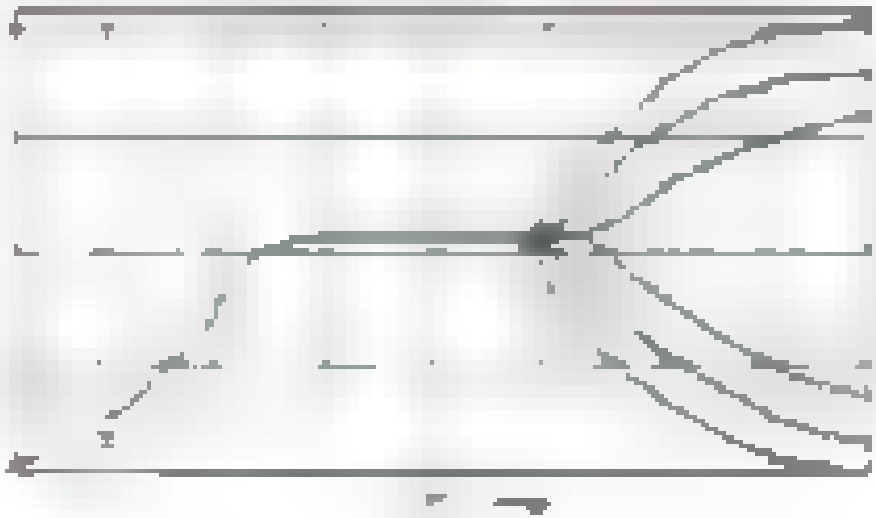


HocusFocus Result

Hardware fails

- a philosophical problem since 1328

- it's not just bad engineering



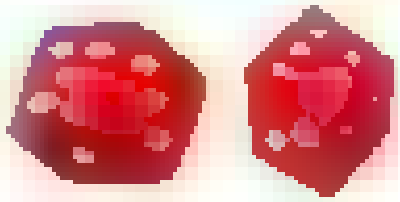
Networks drop packets

- Cambridge MSR / London link

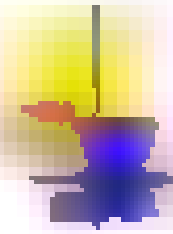
Networks drop packets

- Cambridge MSR / London link

Consider a well known game...



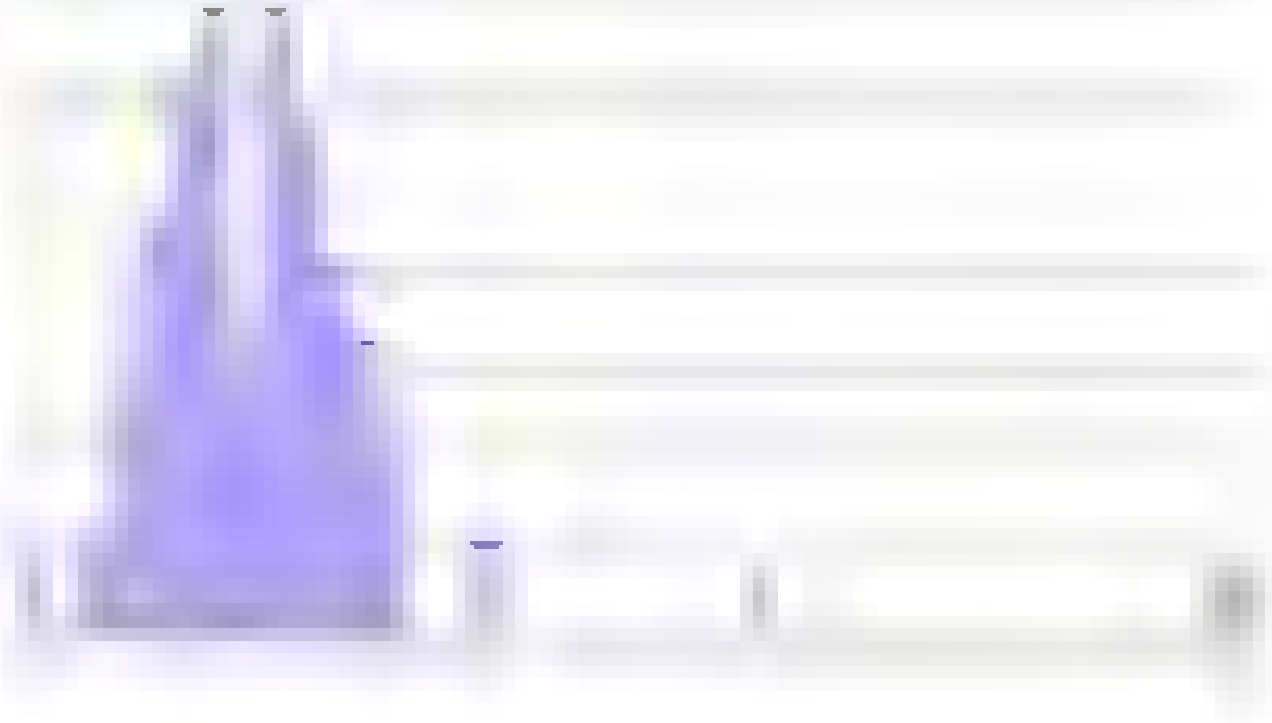
- A board of 41 squares
- Moves based on the roll of two dice
- Some rules



Learn by Observation

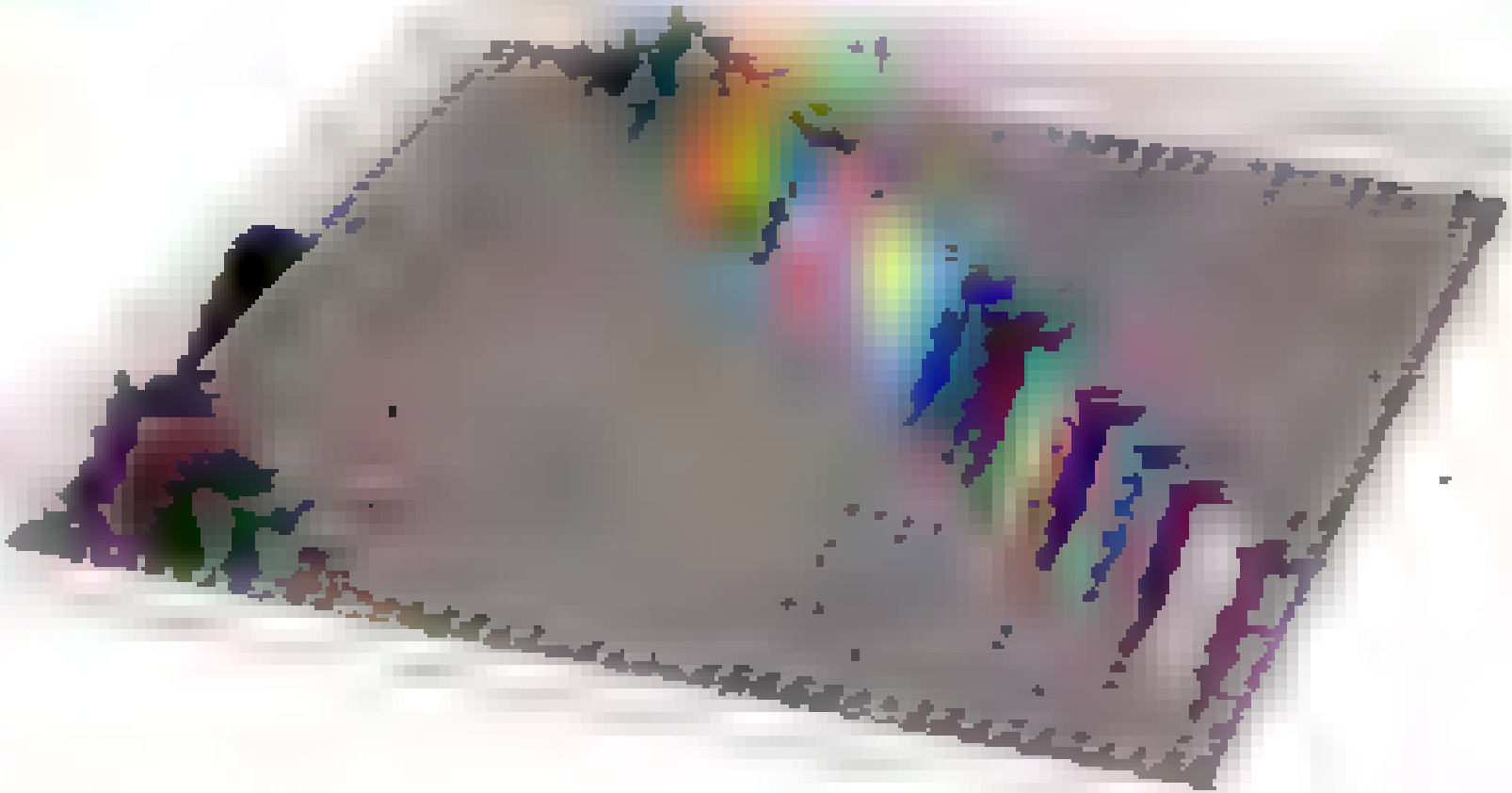
- We watch some games and learn
- The probability of being on a particular square:

Learning more...



- Starting from square 1 – where do we land?

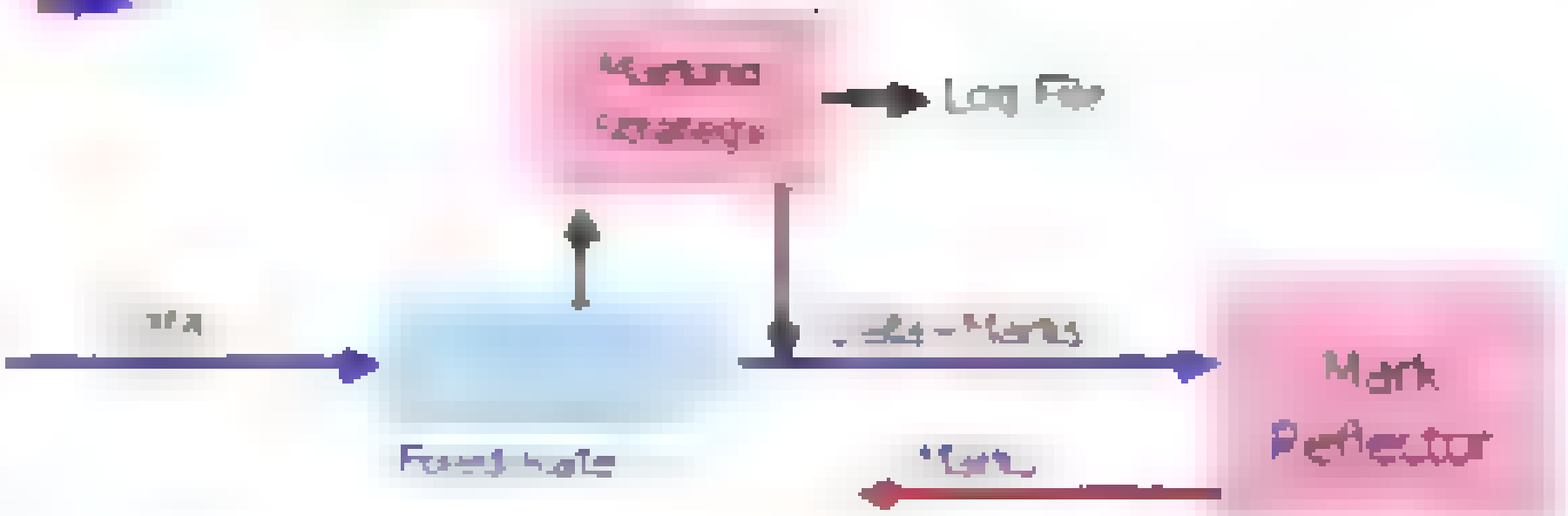
Our Markov Matrix



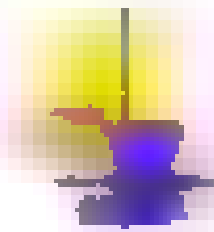
Why learning

- Our example had rules, but maybe:
  - We don't know the rules
  - We can't work out the rules
  - There are too many rules
- Examples:
  - Internet Router configurations
  - System log files

ECN

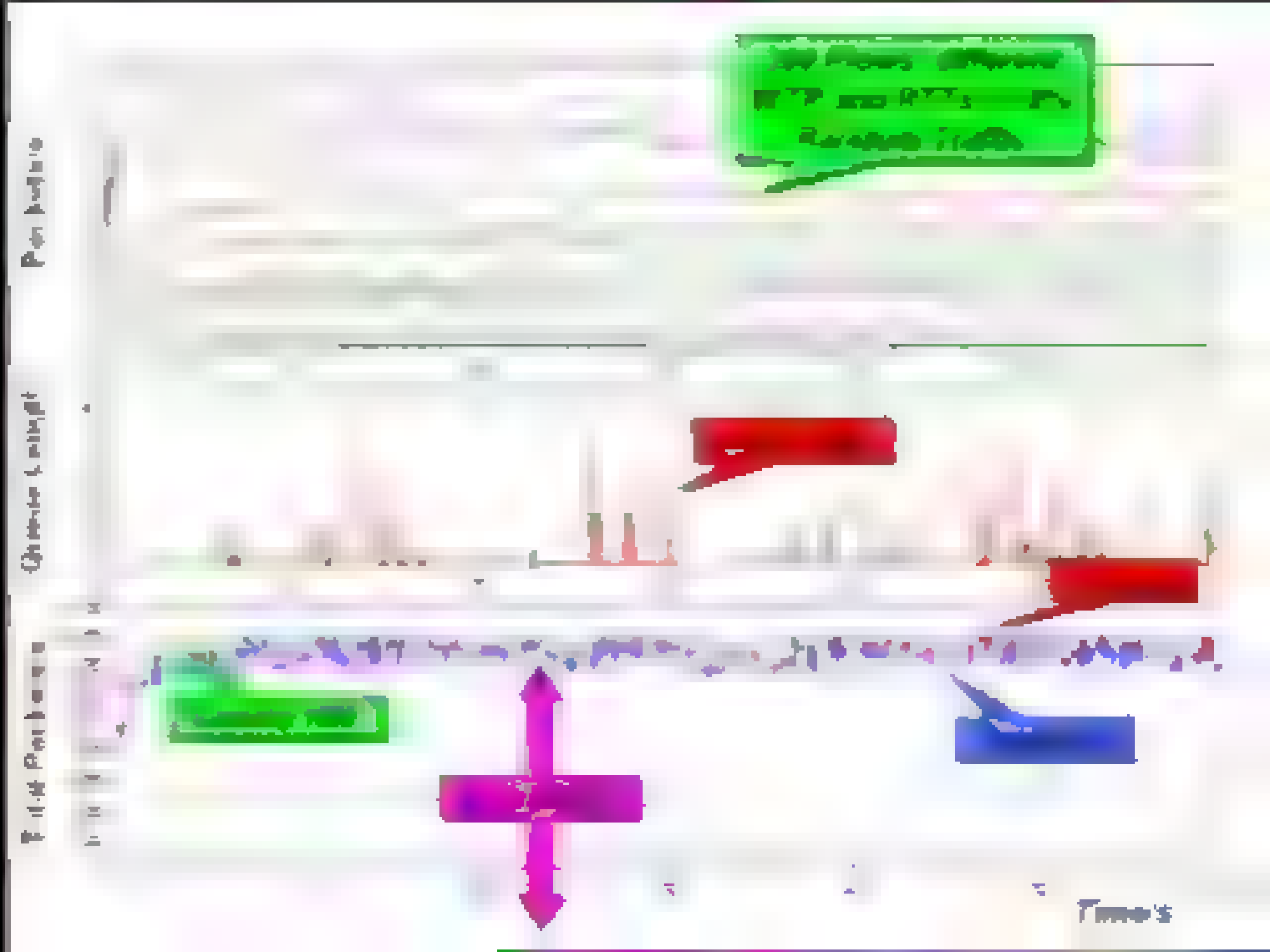


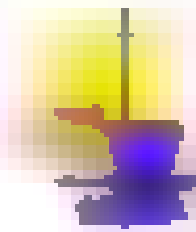
- ECN -- Explicit Congestion Notification
- Data is marked according to some strategy
  - Current RFC suggests use RED algorithm



Congestion pricing

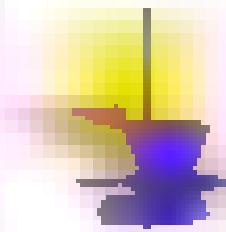
- Economic base strategy
- Original proposal for 1 bit marks
- Current work using 8 bit marks
  - Marks range from [illegible]
  - Zero marks if [illegible] < headroom
  - headroom adjusted by
    - [illegible] growth
    - History
  - [illegible] per packet target mark value





Online measurement

- Large deviations
  - Interested in tails of distribution
  - Traffic aggregation, multiplexer, queue
  - Measure
- SVM
  - Synchronization and periodic effects
  - Try to predict behaviours
- Stability and closed loop effects?



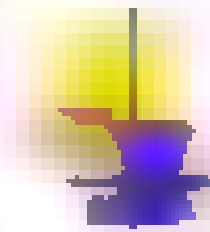
FCOM+

- Validator and Verifier for IL Assembly Code
- Modelling the COM+ Runtime Verification and Execution algorithms
- Testing both the COM+ Runtime C++ Verifier and our own including coverage information
- Specifying and Verifying type soundness for the model

C# genencs

- High-evel design work
- Detailed specs
- A new C# compiler
- Changes to the runtime and IL)
- Accepted for v 2 nearly got into v 1)

http://gamvec/Extended_C_Generics.mdsx.htm



A comment

also hope they talk to someone who's heard of ML or Haskell before they add generics to the language

- ML compiler for .NET
- Haskell compiler for .NET

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What happens if ...

Programming language design and implementation

You have a language problem

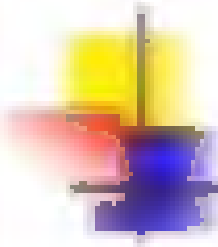
American options

So what...

- Choice of combinators driven by
  - Economy (as few as possible)
  - Expressiveness (can describe many contracts)
  - Efficiency (maps cleanly onto e.g. valuation engine)

Valuation

- Once we have a precise contract specification, we may want to value it



...big win

V(M,C) is compositional

Add value trees point-wise

V(M, c1 `and` c2) = V(M,c1) + V(M,c2)

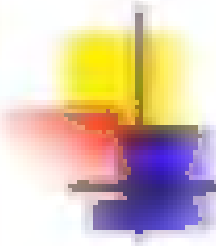
V(M, c1 `or` c2) = max(V(M,c1), V(M,c2))

V(M, give c) = - V(M,c)

V(M, anytime c) = sum(V(M,c))

V(M, get t c) = discount(V(M,c)[t])

etc



And finally

- http://msrweb
- http://camweb/fridaytalk/